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(71) Applicant (for VN only): BLODEK, Jorge [VE/US]; 4690 NW 128 St. Road, Opa-Locka, FL 33054 (US).

(71) Applicants and

(72) Inventors: MENDEZ, Antonio, Alcides [VE/VE]; Calle

A. Res. San Jorge, 8 Fl, Apt 8B, Los Ruices, Caracas (VE). MENDEZ, Pedro, Alfonso [UY/UY]; Carlos Anaya 2646, Montevideo (UY). ALEGRE, Miguel, Angel [UY/UY]; Carlos Anaya 2646, Montevideo (UY).

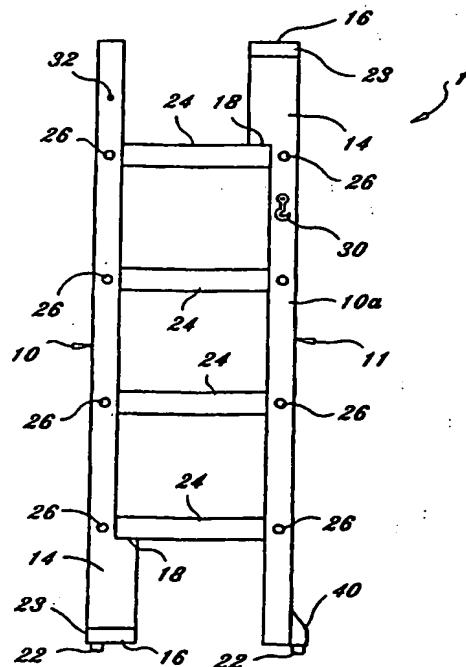
(74) Agents: FLEIT, Martin et al.; Fleit Kain Gibbons Gutman & Bongini, 520 Brickell Key Drive #A201, Miami, FL 33131 (US).

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(54) Title: FOLDABLE LADDER



(57) Abstract: A ladder structure (1) that has two side rails (10, 11). Each rail has an elongated section of a given cross-section defining a channel and an end section of greater cross-section defining a shoulder (14). The side rails are disposed in spaced relation with the channels opening toward each other and with the end section of one rail at the bottom and the end section of the other rail at the top. A series of vertically spaced rungs (24) are pivotally connected to the side rails with the lowest rung pivotally connected in the channels in proximity with the shoulder of one rail, and the highest rung pivotally connected in the channels in proximity with the shoulder of the other rail. The ladder is constructed and arranged dimensionally such

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that one rail can be folded against the other rail to define an enclosed box within which the rungs are contained so that the overall folded dimensions approximate the cross-section of the end sections whereby the ladder presents the smallest volume for storage.

## FOLDABLE LADDER

### BACKGROUND OF INVENTION

#### Field of Invention

The present invention relates to foldable ladders.

#### Description of the prior art

Ladders come in a wide variety of sizes, shapes and configurations, for example, the ladders may be straight, shelf, extension or specialty ladders or may be twin step stepladders, platform stepladders or simple stepladders. In any event it is generally recognized that a ladder is a very useful tool, and is used extensively in the construction trades and for home use.

Despite its wide acceptance as a tool, nevertheless, in practice, there is an impractical aspect to ladders as they are not easily stored when they are not in use. Ladders, it is well known, due to their bulk and shape have to be stored or transported in spaces that require a considerable volume. This is particularly troublesome for sales outlets where an inordinate volume is required to store their ladder inventory.

### SUMMARY OF THE INVENTION

The present invention provides a novel foldable ladder or stepladder which overcomes all the problems experienced in the prior art regarding the storage of such items. Whether the ladder is a straight ladder or a stepladder, a minimum-amount of space for storage is required when not being used. The construction and configuration of the ladders and stepladders of the present invention is such that in a foldable condition, they occupy a minimum volume equivalent to that of a single or

double side rail of the ladder or stepladder. In this manner the ladders and stepladders of the present invention are superior to previously known constructions.

The foregoing is accomplished by a ladder construction as follows. The ladder structure that has two side rails. Each rail has an elongated section of a given cross-section defining a channel and an end section of greater cross-section defining a shoulder. The side rails are disposed in spaced lateral relation with the channels opening toward each other and with the end section of one rail at the bottom and the end section of the other rail at the top. A series of vertically spaced rungs are pivotally connected to the side rails with the lowest rung pivotally connected in the channels in proximity with the shoulder of one rail, and the highest rung pivotally connected in the channels in proximity with the shoulder of the other rail. The ladder is constructed and arranged dimensionally such that one rail can be folded against the other rail to define an enclosed box within which the rungs are contained so that the overall folded dimensions approximate the cross-section of the end sections whereby the ladder presents the smallest volume for storage.

The ladder structure is provided with a shoe on the bottom of one rail, and a shoe is provided on the outside of the other rail adjacent the bottom. A latch is fixed to one rail that cooperates with a latch pin fixed on the other rail to hold the ladder detachably in its folded position. The channels are U-shaped in configuration. The length of the end section is approximately equal to the length of a rung between its connection points. A latch is fixed to one rail that cooperates with a latch pin fixed on the other rail to hold the ladder detachably in its folded position. The length of the end section is approximately equal to the length of a rung between its connection points.

The ladder may be a step ladder that includes support struts of the same configuration as the rails, each associated with a rail, with the struts being pivotally connected at their tops to the tops of the associated rails. The struts are interconnected to at least two cross struts pivotally mounted, one located in proximity with the lower shoulder and the other located in proximity with the upper shoulder. A member is provided connected to a rail and a support strut on each side of the stepladder to control the pivotal spread of the rails and the struts. A latch is fixed to

one rail that cooperates with a latch pin fixed on the associated strut to hold the ladder detachably in its folded position.

Other and further objects and advantages of the present invention will become apparent from the following detailed description of preferred embodiments of the invention when taken with the appended drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is a front elevation view of the novel ladder of the present invention showing the ladder in its unfolded condition ready for use.

Fig. 2 is a perspective view of the novel ladder shown in Fig. 1 as viewed from the side.

Fig. 3 is a front elevation view of the novel ladder of the present invention showing the ladder in its folded condition ready for storage.

Fig. 4 is a side elevation view of the novel stepladder of the present invention showing the stepladder in its unfolded condition ready for use.

Fig. 5 is side elevation view of the novel stepladder shown in Fig. 4 showing the stepladder in its folded condition ready for storage.

#### **DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

Referring now to the drawings, preferred embodiments will now be described in detail. Referring initially to Figs. 1 to 3, the novel foldable ladder of the present invention will be described first. As shown in these Figs. of the drawing, the novel foldable ladder 1 consists of a pair of lateral spaced apart side rails 10, 11, one on each side of the ladder. The side rails are preferably made of aluminum extrusions, fiberglass or wood with elongated sections 10a that define U-shaped channels 12 extending the major length of the rails. An end box section 14, with the same thickness or depth as, but double the width and double the cross-section of the elongated section 10a, is located at one end of each rail. The channels 12 have a base 12a defining the thickness or depth of the ladder 1 and its outside edge. Two legs 12b having free ends 12c of channel 12 project at right angles to base 12a defining the front and rear side edges of ladder 1. The end section 14 of each rail

extends in length from end 16 of the rail for a distance roughly equal to the height of the first step of the ladder or, as shown in the drawing, equal to the length of one rung 24 between its connection points, the reason for which will be explained in the following. The side rails face each other so that the U-shaped channels 12 are open toward the inside and face each other. Also, the rails are inverted relative to one another so that for rail 10, the end section 14 is at the bottom, whereas for the other rail 11, the end section 14 is at the top. The end sections 14 define shoulders 18 equal in width to the width of the elongated sections 10a, 10b, at the joint between the end sections 14 and the elongated sections 10a, 10b, the purpose of which will become clear as this description proceeds.

The rails are fitted at their ends with shoes, such as rubber or plastic shoes 22 which provide a non-slip safety feature. The shoes may be of an articulated design, as is well known in the art, to enable the ladder to sit square on a supporting surface while being tilted against a wall or shelf. Rail 10 has a protective cap 23 at its bottom with its shoe 22 fixed to the bottom of cap 23. Rail 10 does not have any shoe at the top, nor does it have a protective cap 23; its channel 12 is open at the top. Rail 11 has a protective cap 23 at its top, but no shoe 22, and no protective cap 23 or shoe 22 at its bottom; its channel is open at the bottom. However, the bottom of rail 11 has fixed to base 12a at the outside or exterior of the rail, a fitting 40 provided at its bottom or lower end with a shoe 22 that matches the shoe 22 at the bottom of rail 10 so that the ladder will stand levelly on a supporting surface. The top of fitting 40 is tapered to base 12a and fixed to it. Since the fitting 40, which also may be an extruded aluminum channel, is mounted or fixed on the outside of the portion of the rail defining the base 12a of the U-shaped channel 12, it will not interfere during folding, as will become evident hereafter.

The rungs 24 of the ladder are evenly spaced along the rails 10. The ends of the rungs 24 are received in the channels 12 in the side rails 10 and are held in position in the channels by pivot pins 26. The rungs are generally of rectangular or circular shape and their cross-sectional dimensions are selected such that they can be fully accommodated within the channels 12 formed in the rails 10. Also, the rungs 24 nearest the ends of the rail are connected in the channels 12 to the side rails in close proximity to the shoulders 18.

Because the rungs 24 are pivotally mounted to the side rails 10, 11, and are dimensioned to fit within the channels 12, the two side rails can be displaced, see the arrows in Fig. 2, to cause the rungs to pivot into the channels 12, while drawing the side rails together with the free ends of the channels 12 abutting to the folded condition shown in Fig. 3, from the condition shown in Figs. 1 and 2. At this time, the uncapped ends of the rails are resting in proximity to or on the shoulders 18 and the rungs are totally enclosed within the channels 12. When the side rails come together, as shown in Fig. 3, the two channels form an enclosed box, of the same cross-section as box section 14, which completely surrounds the rungs, capturing them within the enclosed box, and diminishing the dimensions of the ladder drastically, whereby it is now suitable for storage in the least possible space. In its folded condition, the ladder now presents a cap 23 and shoe 22 at its bottom, and a cap 23 at its top. The fitting 40 with its shoe 22 now sits compactly protruding to the side roughly at an elevation equivalent to where the bottom shoulder 18 is located.

A latch or hook 30 is pivotally connected to one side of rail 11 between the top and next to the top rungs 24, and a latch pin 32 is fixed to the same side of rail 10 above the top rung 24. The selection of the locations of the latch or hook 30 and latch pin 32 is such that when the ladder is folded into the condition pictured in Fig. 3, the latch or hook can detachably engage the latch pin and hold the ladder in its folded position until the latch or hook is released.

Referring now to Figs. 4 and 5, a novel stepladder 50 is shown in accordance with the teachings of the present invention. The like parts in the Figs. have been designated with the same reference numbers. The novel construction is similar to ladder 1 and utilizes side rails, pivotal rungs, etc. In addition, there are support struts 52 and 53 which are pivotally connected at their tops to the rails 10 and 11 by means of L-shaped brackets 54 and 55 fixed to one side of rails 10, 11 and pivotally connected by pivot pins 57 to struts 52 and 53 at their outside edge or base 12a of channel 12. The struts 52 and 53 have the identical construction as the rails 10, 11. Two cross struts 56 are pivotally connected by pins 58 to the struts 52, 53 at the juncture between the box sections at the top and bottom, as indicated generally by the reference numbers 60 and 61. The L-shaped racket 54 at the top of rail 10

leaves the channel 12 of rail 10 free at the top to receive the top cross strut 56 and to enable the tops of rail 10 and strut 52 to be received on shoulders 18 of rail 11 and strut 53. The bottom of rails 10, 11 and struts 52 and 53 are fitted with non-slip covers or shoes 70, 71. Covers 71 are fitted onto the bottom of rail 11 and strut 53 and do not obstruct the free opening of the channels 12 in these parts, so that when the stepladder is folded or collapsed, the bottoms of strut 53 and rail 11 can be received onto or in close proximity with the shoulders 18 defined on rail 10 and strut 52, and the bottom rung 24 and cross strut 56 can be accommodated in the enclosed boxes created by the components, as previously described. Chains 72 are fixed at each end to a rail 10 and strut 52 and rail 11 and strut 53, respectively, to keep the step ladder from being spread part too much. The location of latch or hook 30 and latch pin 32 is now near or adjacent the bottom of rail 10 and strut 52, respectively. The folded or collapsed condition of the stepladder is shown in Fig. 5.

Although the present invention has been shown and described in terms of preferred embodiments, nevertheless changes and modifications are possible which do not depart from the teachings and scope of the invention. Such changes and modifications as are apparent to one skilled in the art are deemed to fall within the purview of the invention.

**WHAT IS CLAIMED IS:**

1. A ladder structure comprising two side rails, each having an elongated section of a given cross-section defining a channel and an end section of greater cross-section defining a shoulder, the side rails being disposed in spaced lateral relation with the channels opening toward each other and with the end section of one rail at the bottom and the end section of the other rail at the top, a series of vertically spaced rungs pivotally connected to the side rails with the lowest rung pivotally connect in the channels in proximity with the shoulder of the said one rail, and the highest rung pivotally connected in the channels in proximity with the shoulder of the said other rail, the ladder being constructed and arranged dimensionally such that one rail can be folded against the other rail to define an enclosed box within which the rungs are contained so that the overall folded dimensions approximate the cross-section of the end sections whereby the ladder presents the smallest volume for storage.
2. A ladder structure according to claim 1 wherein a shoe is provided on the bottom of one rail, and a shoe is provided on the outside of the other rail adjacent the bottom.
3. A ladder structure according to claim 1 wherein a latch is fixed to one rail that cooperates with a latch pin fixed on the other rail to hold the ladder detachably in its folded position.
4. A ladder structure according to claim 1 wherein the channels are U-shaped in configuration.
5. A ladder structure according to claim 1 wherein the length of the end section is approximately equal to the length of a rung between its connection points.
6. A ladder structure according to claim 1 wherein the ladder is a step ladder.
7. A ladder structure according to claim 6 wherein the stepladder includes support struts of the same configuration as the rails, each associated with a rail, with the struts being pivotally connected at their tops to the tops of the associated rails.
8. A ladder structure according to claim 7 wherein the struts are interconnected by at least two cross struts pivotally mounted, one located in proximity with the lower shoulder and the other located in proximity with the upper shoulder.

9. A ladder structure according to claim 6 wherein a member is provided connected to a rail and a support strut on each side of the stepladder to control the pivotal spread of the rails and the struts.
10. A ladder structure according to claim 6 wherein a latch is fixed to one rail that cooperates with a latch pin fixed on the associated strut to hold the ladder detachably in its folded position.

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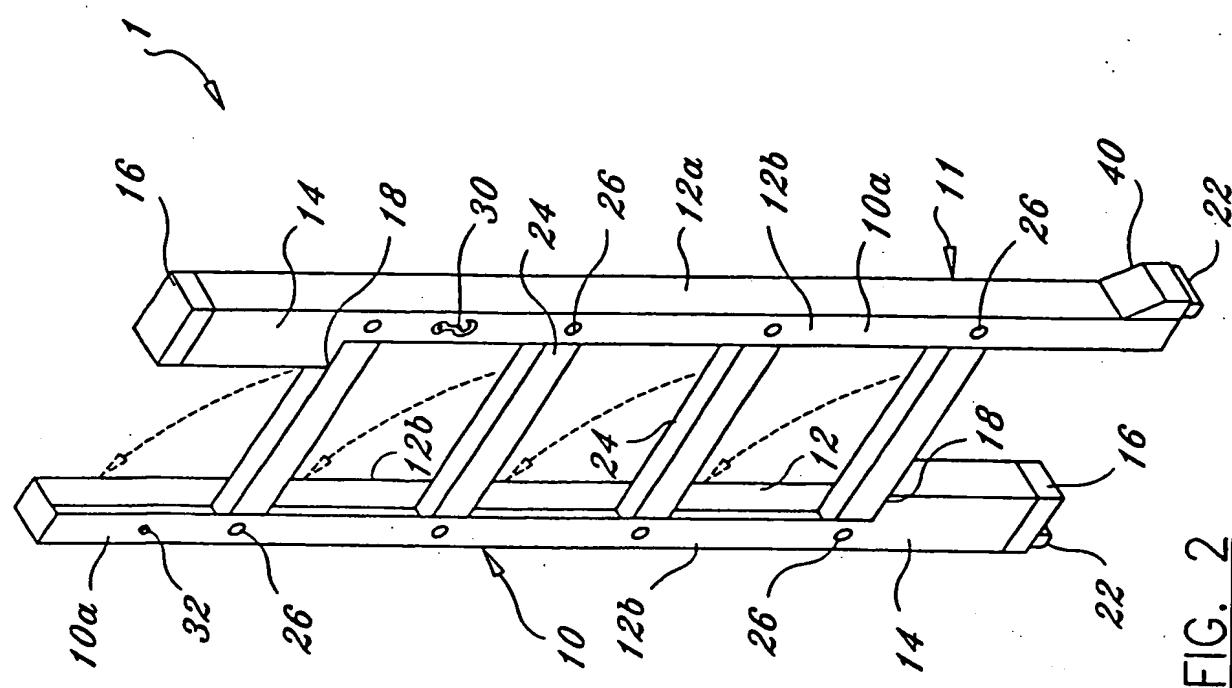


FIG. 2

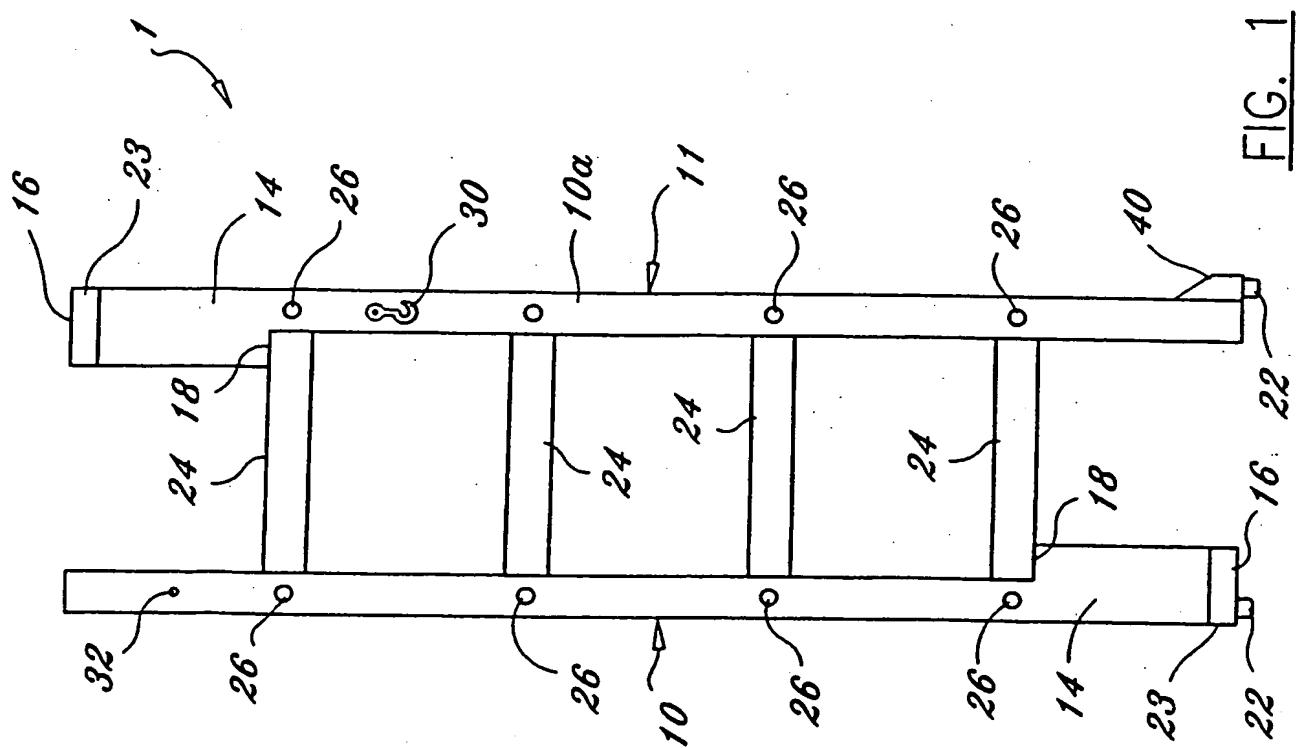


FIG. 1

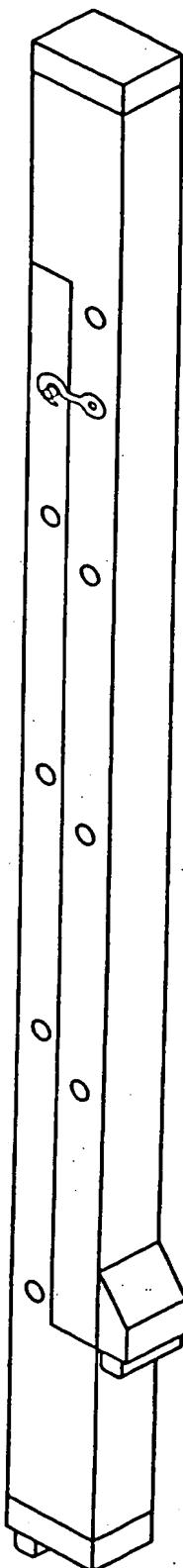


FIG. 3

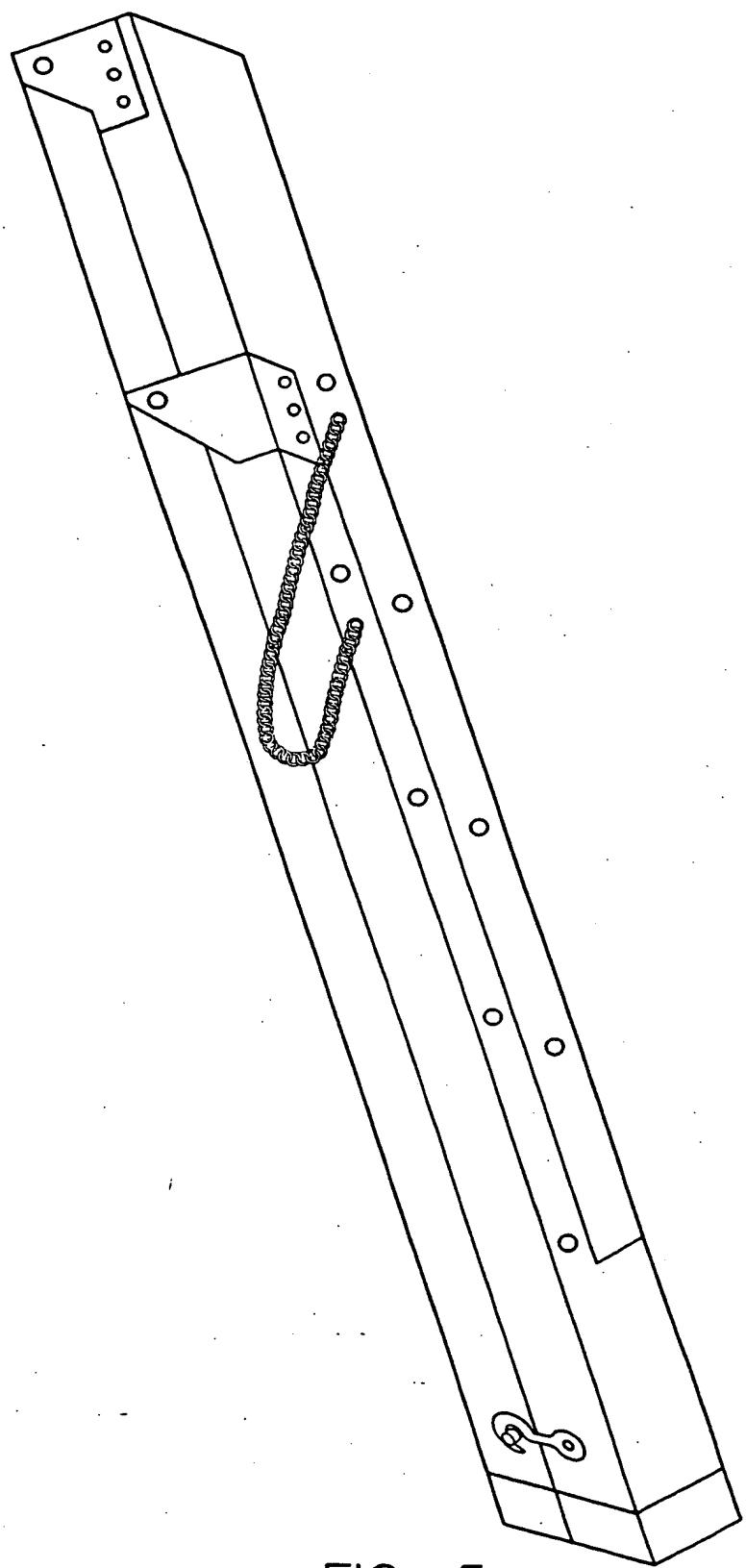


FIG. 5

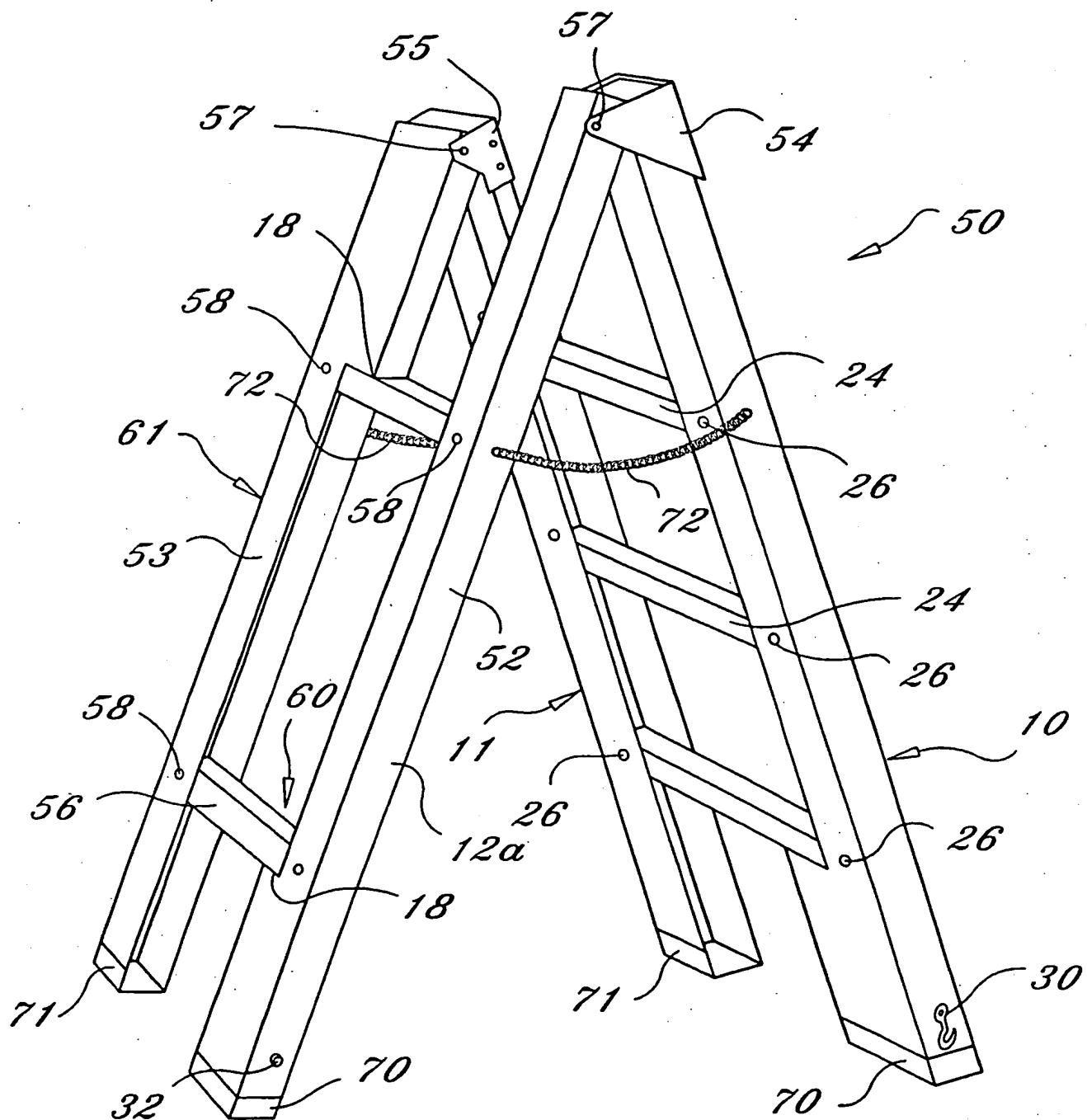


FIG. 4

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/32098

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E06C 1/00

US CL : 182/159

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 182/159,156,160,161,162,96,95

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
BRS, search terms: folding ladders

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1,557,490 A (VIDETTA) 13 October 1925, col. 2, lines 57-110.	1, 3-10
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Y		2
Y	US 4,463,829 A (GRIN) 07 August 1984, col. 4, lines 1-4.	2

 Further documents are listed in the continuation of Box C.

See patent family annex.

Special categories of cited documents	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

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Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

HUGH B. THOMPSON *Diane Smith Jr.*

Telephone No. (703) 305-0102